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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,339	03/29/2004	Brian Lee Lawrence	135476-1/YOD GERD:0088	2691

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EXAMINER	
SUCHECKI, KRYSTYNA	
ART UNIT	**PAPER NUMBER**
2882	

DATE MAILED: 07/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/812,339	LAWRENCE ET AL.	
	Examiner	Art Unit	
	Krystyna Suchecki	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-51* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-51* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 1, 15, 22, 28, 37 and 45 are objected to because of the following informalities: the phrases "to direct electron beam", "to feed electron beam", "to circulate electron beam" and "generating electron beam" are awkward and require an article such as "a", "an" or "the" before "electron beam". Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-5, 7, 12, 13, 16, 17, 19-23, 25-27, 45-47 and 49 are rejected under 35 U.S.C. 102(b) as being anticipated by Sprangle (US 5,353,291).

4. Regarding Claims 1, 3-5, 15-17, 22, 23, 45 and 47, Sprangle teaches a system and method for generating X-rays, the system comprising: a high repetition rate laser (22) adapted to direct high-energy optical pulses in a first direction in a laser cavity (56), wherein a plurality of mirrors are arranged in a ring configuration (Column 3, line 14); an isolator (48) located in the laser cavity for directing the optical pulses in the first direction; and a source of a pulsed electron beam (16) adapted to direct electron beam in a second direction opposite to the first direction in the laser cavity, the electron beam impacting photons in the optical pulses in the laser cavity to produce X-rays (18) in the second direction, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses (Column 4, line 47).

5. Regarding Claims 2 and 46, Sprangle teaches a system and method, further comprising a plurality of mirrors (36, 26, 28, 34) located in the laser cavity for confining the optical pulses within the laser cavity.

6. Regarding Claims 7, 19, 25 and 49, Sprangle teaches a system and method, further comprising an electro-optic cell (Column 4, lines 50-55) and a Brewster plate (36) located in the laser cavity for generating the high repetition rate, mode- locked optical pulses.

7. Regarding Claims 12, 20 and 26, Sprangle teaches a system, wherein the source of a pulsed electron beam is a radio frequency linear accelerator (16).

8. Regarding Claims 13, 21 and 27, Sprangle teaches a system, further comprising one or more magnets (24, 25) to direct the electron beam in the second direction in the laser cavity.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 8-11 and 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sprangle in view of Erbert (US 6,760,356).

11. Regarding claims 8-11 and 50-51, Sprangle teaches system and method for generating X-rays having a stretching and compressing amplification component (42) to rejuvenate the circulating laser beam from a solid state laser (Column 4, lines 1-11 and 60).

12. Sprangle fails to teach particulars of the component such that it comprises a solid state laser rod, a Yb:YAG laser rod, a gating located in the laser cavity for temporally stretching the

optical pulses or a grating located in the laser cavity for temporally compressing the optical pulses.

13. Erbert teaches an amplification system and method using a combination of a grating stretcher, a Yb:YAG laser rod and a grating compressor for providing a high average power signal (Column 2, lines 25-30) with the Yb:YAG additionally providing a long upper state storage time and low thermal loading (Column 3, lines 28-64).

14. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize an amplification system and method using a combination of a grating stretcher, a Yb:YAG laser rod and a grating compressor as taught by Erbert in the system of Sprangle for the benefit of providing a high average power signal (Erbert, Column 2, lines 25-30) with the Yb:YAG additionally providing a long upper state storage time and low thermal loading (Erbert, Column 3, lines 28-64). The combination would provide an additional solid state laser in the system, thereby increasing the amount of laser light for the electron beam to interact with in the system.

Claims 6, 18, 24 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sprangle in view of Weingarten (US 2003/0174741).

15. Regarding Claims 6, 18 and 24, Sprangle teaches the use of a mode-locking device in an X-ray generation system and method above in order to regulate the occurrence of laser pulses (Column 4, lines 43-49)

16. Sprangle fails to teach an acousto-optic cell located in the laser cavity for generating the high repetition rate, mode-locked optical pulses.

17. Weingarten teaches that it is known in the art to use an acousto-optic modulator as an intracavity element to produce short, picosecond pulses (Paragraph 2).

18. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an acousto-optic cell located in the laser cavity as taught by Weingarten in the system and method for generating high repetition rate, mode-locked optical pulses of Sprangle, since the arrangement is established in the art for the generation of short pulses (Weingarten, Paragraph 2).

19. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sprangle in view of Antonell (US 2001/0043667).

20. Regarding Claim 14, Sprangle teaches an X-ray beam (18) exiting a generation system through a window (54).

21. Sprangle is silent on further directional motion of the X-ray away from the laser cavity.

22. Antonell teaches X-ray diverting means (Figures 1-13) wherein multiple Bragg reflectors, in the form of plural crystals, collectively provide predictable diffraction angles for x-rays to propagate towards a sample (Paragraphs 6-9) for the benefit of providing parallel or convergent radiation for a variety of applications (Paragraph 2) from a common source (Paragraph 6).

23. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Bragg reflectors of Antonell to direct X-rays in a pre-determined direction from the laser cavity of Sprangle for the benefits of providing parallel or convergent radiation for a variety of applications (Antonell, Paragraph 2) from a common source (Antonell, Paragraph 6).

24. Claims 28-30, 32-38 and 40-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sprangle in view of Hartemann (US 6,724,782).

25. Regarding Claims 28, 29, 33-37 and 41-44, Sprangle teaches a system for generating X-rays, the system comprising: a mode-locked laser (Column 4, lines 43-49 and 59-63) adapted to direct high-energy optical pulses in a first direction in a laser cavity having a ring configuration (Column 4, line 64- Column 5, line 1 and Figure 2); the laser cavity further comprising an isolator (48) for directing the optical pulses in the first direction; a source of a pulsed electron beam in an electron storage ring (164) overlapping the laser cavity, the electron storage ring adapted to circulate electron beam in a second direction opposite to the first direction in the laser cavity, the electron beam impacting photons in the optical pulses in the laser cavity to produce X-rays in the second direction (Column 5, lines 31-61). The (storage ring) betatron (164) stores and circulates the electron beam and includes an amplifier to accelerate the electron beam circulating in the electron storage ring (Column 5, lines 57-60).

26. Sprangle fails to teach a source of a pulsed electron beam adapted to feed electron beam in an electron storage ring overlapping the laser cavity wherein the pulsed electron beam originates from a radio frequency linear accelerator and wherein the storage ring stores and circulates the electron beam, and includes an amplifier to accelerate the electron beam circulating in the electron storage ring, and the round trip circulation time of the electron beam in the electron storage ring is substantially equivalent to a round trip time of the optical pulses in the laser cavity.

27. Hartemann teaches a system for generating X-rays having a source (11) of a pulsed electron beam adapted to feed electron beam in an electron storage ring (12) overlapping a laser cavity (26). Hartemeann's pulsed electron beam originates from a radio frequency linear accelerator system (11). The storage ring (12) stores and circulates the electron beam and includes an amplifier to accelerate the electron beam circulating in the electron storage ring (Column 4,lines 47-64). The round trip circulation time of the electron beam in the electron storage ring is substantially equivalent to a round trip time of the optical pulses in the laser cavity (Column 5, lines 4-9). Hartemann teaches the pulsed system feeding the storage ring for the benefits of system compactness and minimal jitter (Column 3, line 65- Column 4, line 12).

28. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the source of a pulsed electron beam (radio frequency linear accelerator system) adapted to feed electron beam in an electron storage ring as taught by Hartemann in the system of Sprangle in order to have a storage ring that stores and circulates the electron beam and includes an amplifier to accelerate the electron beam circulating in the electron storage ring (Column 4,lines 47-64) and that has a round trip circulation time of the electron beam in the electron storage ring is substantially equivalent to a round trip time of the optical pulses in a laser cavity (Column 5, lines 4-9) for the benefit of having an X-ray generation system that is compact and has minimal jitter (Hartemann, Column 3, line 65- Column 4, line 12).

29. Regarding Claim 29, Sprangle teaches a system, further comprising an isolator (48) located in the laser cavity for directing the optical pulses in the first direction.

30. Regarding Claims 30 and 38, Sprangle teaches a system, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses (Column 4, line 47).

31. Regarding Claim 32 and 40, Sprangle teaches a system, further comprising an electro-optic cell (Column 4, lines 50-55) and a Brewster plate (36) located in the laser cavity for generating the high repetition rate, mode- locked optical pulses.

Claims 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sprangle in view Hartemann, as taught for claims 28 and 37 above, and further in view of Weingarten (US 2003/0174741).

32. Regarding Claims 31 and 39, Sprangle in view of Hartemann, as taught for Claims 28 and 37 above, teach the use of a mode-locking device in an X-ray generation system above in order to regulate the occurrence of laser pulses (Column 4, lines 43-49)

33. Sprangle in view of Hartemenn fails to teach an acousto-optic cell located in the laser cavity for generating the high repetition rate, mode-locked optical pulses.

34. Weingarten teaches that it is known in the art to use an acousto-optic modulator as an intracavity element to produce short, picosecond pulses (Paragraph 2).

35. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an acousto-optic cell located in the laser cavity as taught by Weingarten in the system of Sprangle as modified by Hartemann for generating a high repetition rate, mode-locked optical pulses, since the arrangement is established in the art for the generation of short pulses (Weingarten, Paragraph 2).

Conclusion

36. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Krystyna Suchecki whose telephone number is (571) 272-2495. The examiner can normally be reached on regular working days and hours.

37. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

38. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER